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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/905,398	07/14/2001	Nace Layadi	120747/075903.001	3744

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EXAMINER

MAI, ANH D

ART UNIT PAPER NUMBER

2814

DATE MAILED: 10/28/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/905,398

Applicant(s)

LAYADI ET AL.

Examiner

Anh D. Mai

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 July 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5,7 and 19-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5,7 and 19-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. In view of the appeal brief filed on July 16, 2003, PROSECUTION IS HEREBY REOPENED. A new ground of rejection is set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

- (1) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,
- (2) request reinstatement of the appeal.

If reinstatement of the appeal is requested, such request must be accompanied by a supplemental appeal brief, but no new amendments, affidavits (37 CFR 1.130, 1.131 or 1.132) or other evidence are permitted. See 37 CFR 1.193(b)(2).

Status of the Claims

2. Claims 1-5, 7 and 19-21 are pending.

Claim Rejections - 35 USC § 102/103

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 19 and 20 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Brennan (U.S. Patent No. 6,211,072) of record⁹.

With respect to claim 19, insofar as the structure is concerned, Brennan teaches semiconductor structure as claimed including:

- a substrate layer (12);
- a dielectric layer (20) disposed over the substrate layer (12) and having a via (24) formed therein;
- a polish stop layer (28) comprising titanium nitride alloyed with carbon disposed over the dielectric layer (20) and extending into the via (24); and
- a metal layer (26) disposed over the polish stop layer (28) and filling the via (24). (See Fig. 5).

With respect to the hardness of the titanium nitride alloyed with carbon (28) as compared to that of titanium nitride material, since the TiCN (28) of Brennan is titanium nitride alloyed with carbon, therefore, the TiCN layer (28) of Brennan is inherently has the hardness as claimed.

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Further, since the TiCN layer (28) of Brennan comprises a same material as claimed (titanium nitride alloyed with carbon), it should function the same.

With respect to claim 20, the percentage weight of carbon in the TiCN layer (5%) of Brennan is within the claimed range (5 to 20 %).

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 1-5, 7 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamashita et al., (JP. Patent No. 08-107148) in view of Meikle et al., (U.S. Patent No. 5,231,306) (all of record).

With respect to claim 1, insofar as the structure is concerned, Yamashita teaches a semiconductor device substantially as claimed including:

a substrate (21) having a device feature formed thereon;

a dielectric layer (28) disposed over the substrate (21) and device feature and having at least one contact hole (29) formed therein;

a polish stop layer (30) disposed over the dielectric layer (28) and extending within the contact hole (29);

a layer of metal (31) disposed over the polish stop layer (30) within the contact hole (29) and formed a plug; and

wherein the polish stop layer (30) comprises titanium nitride (TiN). (See Fig. 9).

Thus, Yamashita is shown to teach all the features of the claim with the exception of using TiAlN for the polish stop layer (30).

However, Meikle teaches that TiAlN are known in the art to be used in place of TiN in semiconductor devices.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the polish stop layer (30) of Yamashita using TiAlN as taught by Meikle because TiAlN is more resistant to diffusion than TiN, can be etched and sputter like TiN, better thermal budget and better stability on silicon, thus, can replace TiN in many of its uses in semiconductor device. (See abstract).

With respect to claim 2, the semiconductor device of Yamashita further includes a metal coating (27) under the dielectric layer (28), the metal coating (27) comprises titanium nitride. Note that, as discussed previously, in view of Meikle, metal compound of titanium nitride and aluminum (TiAlN) can be used in place of the TiN layer (27).

With respect to claim 3, the dielectric layer (28) of Yamashita comprises SiO₂.

With respect to claim 4, the metal coating (27) of Yamashita comprises an ARC.

With respect to claims 5 and 7, the barrier layer of Meikle comprises TiAlN and appears to have aluminum percentage weight as claimed.

With respect to claim 21, insofar as the structure is concerned, Yamashita teaches a semiconductor device substantially as claimed including:

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a metal layer (25) disposed on a substrate (21);
a barrier layer (27) disposed on the metal layer (25);
a dielectric layer (28) disposed on the barrier layer (27);
a patterned layer of photoresist (not shown) disposed on the dielectric layer (28) exposing
a selected portion of the dielectric layer (28);
wherein the barrier layer (27) function as an etch stop layer. (See Fig. 4).

Thus, Yamashita is shown to teach all the features of the claim with the exception of using TiAlN for the barrier layer (27).

However, Meikle teaches that titanium aluminum nitride (TiAlN) are known in the art to be used in place of barrier layer (TiN) in semiconductor devices.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the polish stop layer (30) of Yamashita using TiAlN as taught by Meikle because TiAlN is more resistant to diffusion than TiN, can be etched and sputter like TiN, better thermal budget and better stability on silicon, thus, can replace TiN in many of its uses in semiconductor device. (See abstract).

Note that, the barrier layer (27) of Yamashita, in view of Meikle, is function as an etch stop layer, thus, upon removal of the selected portion of the dielectric layer (28), the barrier layer (27) prevents the etching process from compromising the underlying metal layer.

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With respect to the patterned photoresist layer (not shown), the formation of the patterned photoresist is well known in the art. (See S. Wolf et al. *Silicon Processing for the VLSI Era*. Vol. 1, pp. 407-409).

Response to Arguments

5. Applicant's arguments with respect to claims 19 and 20 have been considered but are moot in view of the new ground(s) of rejection.

6. Applicant's arguments filed July 16, 2003, with respect to claims 1-5, 7 and 21 have been fully considered but they are not persuasive.

With respect to claim 1, contrary to Applicants assertion, the *prima facie* has clearly been established. Meikle teaches the advantages of using TiAlN in place of TiN. TiAlN is more resistant to diffusion than TiN, can be etched and sputter like TiN, better thermal budget and better stability on silicon, thus, can replace TiN in many of its uses in semiconductor device. (See abstract).

Therefore, using the teaching of Meikle, one having ordinary skill in the art, such as the present inventors, should not hesitate to use TiAlN in place of TiN.

With respect to using the TiAlN as a polish stop layer, Meikle clearly teaches: "thus can replace TiN in many of its uses in the semiconductor devices" (see Abstract). Yamashita clearly uses the TiN (30) as a polish stop layer. (See Fig. 7). Therefore, in view of Meikle, TiAlN can be used as the polish stop as well.

Note that, replacing a well known material for another well known material for a same function is a preference, thus, obvious.

In response to applicant's argument that TiAlN is intended to be used as a polish stop layer, a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963).

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Meikle clearly teaches that there are more advantages to use TiAlN in place of TiN.

With respect to claim 21, similar reasoning as that of claim 1 should also be considered here. Replacing TiAlN of Meikle for layer (27) of Yamashita clearly within the teaching of Meikle.

Further, Applicants argument with respect to claim 21 is non-responsive because the limitation of claim 21 includes: lines 5-6 "a patterned layer of photoresist disposed on the dielectric layer exposing a selected portion of the dielectric layer" (See Fig. 3). Thus, etching or non-etching of the TiAlN is irrelevant.

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In response to applicant's argument that "layer of titanium aluminum nitride **functions** as an etch stop layer", a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.



A.M
October 24, 2003